

WAVES 1

1. (a) 25 000 Hz; 1
 (b) frequency is too high/outside range of hearing/too high pitch; 1
 (c) B; 1
[3]
2. (a) (i) to the left; 1
 (ii) current produces magnetic field/coil becomes magnetic;
 cause of movement in correct context;
 [Reject attraction/repulsion] 2
 (b) oscillates/vibrates/moves left then right/eq; 1
 (c) $v = f \times \lambda$; [In any correct form]
 $= 800 \text{ (Hz)} \times 0.4 \text{ (m)}$;
 $= 320 \text{ (m/s)}$; [Bald correct answer scores 3 marks] 3
[7]
3. (a) (i) top diagram shows:
 1. circular waves;
 lower diagram shows:
 2. less diffraction than top diagram;
 either diagram shows:
 3. at least three waves shown;
 4. no change in wavelength in these waves; 4
 (ii) wavelength; 1
- (b) (i) wavelength = $\frac{\text{speed}}{\text{frequency}}$; [In any correct form]
 $= \frac{330 \text{ m/s}}{1000 \text{ Hz}}$;
 $= 0.33 \text{ m}$ 2
 (ii) yes plus two from:
 1. the waves spread at the opening;
 2. sound/waves are diffracted;
 3. as the gap is comparable to the wavelength/OWTTE; 2
 (iii) An explanation to include:
 1. wavelength is smaller/calculation;
 2. waves would not spread/diffract as much;
 3. as much smaller than gap; 3

[12]

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|----|-----|------|---|---|
| 4. | (a) | (i) | greater/higher/more/larger/bigger;
[Reject longer] | 1 |
| | | (ii) | longitudinal; | 1 |
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	(b) (i) vibration;	1	
	(ii) 1.6;; [Allow 1.3 / 3.2 / 16 for 1 mark] [2.6 scores no mark]	2	
	(iii) 0.004;	1	
	(c) (i) reduced amplitude; longer period shown; (One cycle to be shown)	2	
	(ii) quieter/softer/less loud/volume lower/harder to hear; lower/deeper (sound)/pitch decreases/more bass;	2	
			[10]
5.	(a) (i) VHF / 100 (MHz);	1	
	(ii) long; long range/OWTTE;	2	
	(iii) VHF / 100 (MHz); (high) amount of information carried/enables stereo broadcasts;	2	
	(iv) long and medium;	1	
	(b) A diagram showing: • constant frequency; • varying amplitude (no pattern required);	2	
			[8]
6.	(a) (i) B;	1	
	(ii) A;	1	
	(b) Hz;	1	
	(c) (i) An explanation to include: 1. ripples are transverse waves; 2. (movement) displacement only in the vertical plane;	2	
	(ii) energy;	1	
			[6]
7.	(a) (i) changes direction; towards the right;	2	
	(b) no refraction at first boundary; reflected at second and third boundaries; ray emerging from prism parallel to incident ray;	3	
	(c) at least three waves; diffraction shown; no change in wavelength;	3	

8. (a) (i) refract(ion);

- (ii) An explanation to include:
1. the ray bends (through an angle) / changes direction / refracts;
[Reject bends **in** water]
[Ignore reference to light direction] 2
 2. the fisherman thinks it has travelled straight / virtual image;
- (b) correct direction;
joined; 2
[Deduct 1 mark for each error]

[5]

9. (a) (i) higher the frequency the greater the energy / ORA; 1
- (ii) An explanation to include:
1. can penetrate body / skin;
[Allow absorb / enter]
 2. causing effects such as mutations, skin cancer etc /
ionise the cells / damage cells / tissue; 2
- (iii) as the frequency increases the wavelength decreases; 1
(may write $v = \lambda \times f$)

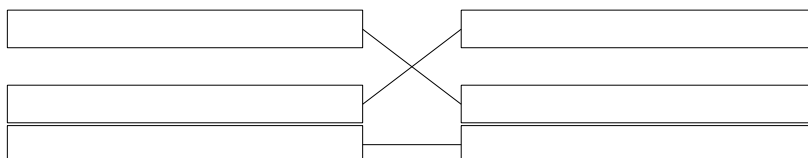
- (b) Any two correct statements, for example:
1. ultrasound are sound waves, radio waves are electromagnetic waves;
 2. ultrasound are longitudinal, radio waves are transverse;
 3. radio waves travel at the speed of light, ultrasound are much slower;
[Allow faster than]
 4. radio waves can travel through a vacuum, ultrasound needs a
medium; 2
- [NB **comparison** has to be made]
[Ignore references to uses, wavelength and frequency]

[6]

10. (a) 2 arrows in opposite directions;
not along the spring's direction; 2
- (b) sound / p wave / compression wave / ultra sound / sonar; 1
- (c) (i) 3; 1
- (ii) 10;; 2
[5 - 1 mark only]
- (iii) A calculation to include:
1. $f = \frac{14}{7}$;
 2. 2;
 3. Hz; 3

[9]

11. (a) infra-red/IR; 1
 (b)



3 correct;; 2
 (1/2 correct – 1 mark)

[3]

12. (a) (i) B (no mark) 1
 biggest/largest/highest amplitude/highest/tallest wave/biggest displacement/ quantified from graph (using a comparison);
 (ii) any two from 2
 molecules of air vibrate (to and fro);
 push together/at high pressure/compression/
 then moves further apart/at lower pressure/raref action;
 the vibrations are passed on;
 (sound is a) longitudinal (wave);
 molecules=particles

- (b) Two from: 2
 body scan(ning);cleaning surgical instruments [**ignore** sterilising];
 treating muscle strains/joints/ligaments;
 treating cataracts;
 breaking up kidney stones/gallstones;
 dentistry;

[5]

13. (a) refraction towards normal in block; (must emerge at bottom surface) 2
 emergent ray correctly refracted; (approx parallel to incident)
 (b) (i) sunbeds/ security marking – detection of forged bank notes/
 fluorescent lamps/treatment of skin complaints/ sterilisation of
 water/hardening fillings;
 IGNORE: uv lamps 1
 (ii) uv higher frequency/visible lower frequency; 2
 uv shorter wavelength/visible longer wavelength;
 travel at the same speed; accept labelled diagram
 (c) (i) X-rays absorbed stopped/by bone; 3
 pass through/flesh/(soft) tissue/muscle;
 IGNORE arm/see through skin etc.
 they affect a photographic film/darken photographic plate;
 (ii) kills/damages cells/DNA/genes/chromosomes/cause cancer/mutations/
 infertility; 1
 ionisation;
 IGNORE damages tissue;

[9]

14. (a) reflected; (NOT refracted) 3
(incidence;
critical;
- (b) they enable light to travel round corners 1
/flexible/thin/narrow/transparent **or** energy efficient/little energy loss
or (internally)reflect light;
- [4]
15. (a) $f = v / \lambda$ or in words; 1
- (b) Any **two** from: 1
high (frequency) means shorter wavelength ORA explicitly shown in words
or on diagram;
more diffraction for low frequency because wavelength similar to door
width/ORa; 1
(diagrams must show **same** aperture size, **different** wavelengths,
and correct **diffraction** for two marks)
- [3]